IMPERIAL GEOLOGICAL SURVEY OF JAPAN,

WITH

A CATALOGUE OF ARTICLES

EXHIBITED BY

THE GEOLOGICAL SURVEY

AT

THE WORLD'S COLUMBIAN EXPOSITION.

PUBLISHED BY
THE IMPERIAL GEOLOGICAL SURVEY OF JAPAN,
DEPARTMENT OF AGRICULTURE AND COMMERCE,
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IMPERIAL GEOLOGICAL SURVEY OF JAPAN.

HISTORY.

The first geological examination[1] of Japan was undertaken by Mr. T. Wada, in 1878, under the Geographical Bureau (the Chiri kyoku) of the Home Department, and only the provinces of Kai and Izu were reconnoitred. At the end of the same year Dr. Edmund Naumann, then Professor of Geology in the Tokyo University, advised to establish the systematic geological survey for the purpose of developing the natural resources of the Empire, and submitted a plan to the Minister of the Interior. In May 1879, the above plan was adopted and the present Imperial Geological Survey was established, the work of the Survey being placed under

[1] Prior to this, in 1862, the Cabinet of the Tokugawa Government engaged the services of two American mineralogists and mining engineers, Messrs. P. Blake and R. Pumpelly, in order to examine the mineral resources of Hokkaidō (Yesso). They made only some observations in the southern part of the Hokkaidō around Hakodate and Volcano Bay; and their results are found in Pumpelly's 'Geological Researches in China, Mongolia and Japan' and Blake's 'Reports and official letters to the Kaitakushi.' After an interval of ten years geological survey of Hokkaidō was resumed in the spring of 1873, and the work was carried out under the superintendence of Mr. B. S. Lyman till the year 1875. He made with many assistants special surveys of the coal fields and other mineral districts; while his general exploration was made chiefly along the sea-coast of the largest island, and across the central volcanic mountain-range from the Ishikari valley to the mouth of the Tokachi river. The results attained by him have all been published in reports accompanied by maps. As the geological survey of the Hokkaidō has been done from such an early date, and is still at present executed independently by the Hokkaidōchō, the organization of the Imperial Geological Survey has excluded the geological examination of that part of the Empire. For further progress see an appendix of the present paper, where a short account of the progress of the geological survey of Hokkaidō is given.

the direction of Dr. E. Naumann. As much time was spent in the preparation, the survey was not commenced till the next year. In 1881, the Government established the Department of Commerce and Agriculture (the Nōshōmushō), and transfered the work of Geological Survey to the ministry of that department, forming a section of the Agricultural Bureau. In 1882, the Geological Survey was separated from the above Bureau, and became independent, under the name of 'Chishitsu-chō-sajo' (Geological Survey Institute), and at the same time organization was fixed. Mr. T. Wada was appointed as director, and Dr. E. Naumann as chief geologist. The works of both the topographical and geological sections were placed under the direct control of Dr. E. Naumann, while those of the agronomical and chemical sections were in charge of Prof. Dr. M. Fesca[1] and Mr. O. Korschelt respectively. In 1885, Dr. T. Harada succeeded Dr. E. Naumann, as inspector of both geological and topographical surveys, and also since 1884, the work of the chemical laboratory has been placed under the direction of J. Takayama. Thus the work of the Survey as a whole has from many years since been executed mostly by our countrymen with great energy and success.[2]

ORGANIZATION AND FUNCTIONS.

According to the original plan, adopted by Dr. E. Naumann, the objects of the Geological Survey of Japan are :—

1. A topographical survey of the whole Empire (Hokkaido excluded): the construction of geological maps, showing the distribution of the different formations at the surface and the construction of as many cross-sections as is necessary to illustrate the geological structure of the country.

2. An agronomical survey : the construction of maps, showing the soils, and an examination of the soils to show the means of improving and preserving their fertility ; especially an agronomical

[1] Dr. Liebscher directed the work of the agronomical section prior to Prof. Dr. Fesca, but his service was soon dispensed with.

[2] See the *personnel* and progress of the Survey in the sequel.

survey of those portions of the Empire which are not yet under cultivation, but capable of cultivation; and the quality, abundance and accessibility of the different mineral manures.

3. An examination of Japanese ores and coals, of deposits of such materials as may be used for art and manufacture, of building stones, road materials, etc., etc.

The proposed scale of the maps to be published is 1 : 200000. The single division maps, corresponding to divisions of degree-rectangles should have a length of 0.456 meters and a height of 0.277 meters (1° of longitude and $\frac{1}{2}$° of latitude). This would make 97 division maps altogether (in 97 topographical, 97 geological and 97 agronomical maps). Eight maps should be finished in one year if the duration of the survey be about twelve years. To accomplish the above task the following *staff* is required:—

1 foreign director.
12 (if possible more) Japanese geological assistants.
1 foreign topographer.
6 Japanese topographical assistants.
1 foreign agronomical surveyor.
6 Japanese agronomical assistants.
1 foreign chemist.
6 Japanese chemical assistants.
6 Japanese cartographers.
1 Japanese stone cutter.
Subordinate assistants.

The present organization does not differ much from the above plan, but there are some points deviating from it. Thus it has been decided to publish beside the special topographical and geological maps (scale 1 : 200000), a reconnaissance map of Japan (Hokkaidō excluded) on a scale of 1 : 400000, with the end of showing the general topographical and geological features of the whole country. As the agronomical map on the scale of 1 : 200000 is too small to put in detail the distribution of different kinds of soils on it, it has been proposed to enlarge the scale to 1 : 100000; and at the same time to divide the maps not according to longitudes and latitudes, but by the boundaries of *Ken* or *Fu* (Prefecture). It has been determined to attach an

explanatory text to each geological or agronomical map and also to issue bulletins, comprising the results of either geological, agronomical, chemical, or topographical investigations conducted by the Survey. Lastly the *staff* of technical officers has been, and is, less than that required by the original plan, on account of pecuniary difficulties.[1]

For effecting the objects above mentioned, the Survey is divided into four divisions, viz.: I. Geological Section. II. Agronomical Section. III. Topographical Section. IV. Chemical Section. Let us see how the works of above sections are carried on.

I. Geological Section.—The scope of the geological section is to make systematic geological examination of the whole country with a special regard to economic requirements. Besides it is required to make a basis for agronomical survey prosecuted by the agronomical section. The work of the section is accordingly divided into the five following heads: 1. Field work. 2. Office work. 3. Production and publication of maps. 4. Preparation and publication of explanatory texts etc. 5. Museum.

1. *Field work.*—For this work, the geologist is required to make an accurate examination of the geological deposits and their structure of the region appointed by the Survey, and to collect from the said region the specimens of rocks, minerals, or fossils. Besides he is obliged to make sketches of the routes he has traversed, on the scale of 1 : 50000 , and to put on them the detailed information of the boundary lines of different geological deposits, the relation of the rocks to each other, the position of available building materials, ores, coals etc.

Profiles of the region and sections of the ground, whether artificial or natural, are also to be noticed and sketched. To execute the above task, the geologist is equipped with following instruments: Clinometer. Piedmeter. Aneroid barometer. Thermometer. Pocket alt-azimuth instrument. Sketching board with compass and other requisites. Hammer etc. For special works, such as the examination of the important mining districts, the sources of water supply, the investigation of districts devastated

[1] See the *personnel* of the Survey in the sequel.

by earthquake, volcanic eruption or landslips etc., the detailed survey will be made with accurate instruments.

2. *Office work.*—The specimens of rocks, fossils and minerals collected in the course of the field work are treated under the following heads :

a. Determination of rocks by microscopical and chemical investigations.

b. Determination of fossils and deduction therefrom the relative geological position or age of rocks or formations.

c. Investigation of minerals and other useful substances with a special regard to their economical appliances.

The analysis of minerals and rocks and the assays of ores and other useful substances are however prosecuted by the chemical section. After finishing the above task, the geologist is to construct a geological map of the region just surveyed on the scale of 1 : 100000, with the help of the basic maps which have been prepared by the topographical section. Also the geological sections are to be made either in a true or exaggerated scale. The map above constructed will become a basis of the geological map for publication.

3. *Production and publication of maps.*—As has already been mentioned there are two kinds of geological maps for publication. The one called reconnaissance map is on the scale of 1 : 400000 and represents the general geological features of the country ; the other known under the name of special map or sheet is on the scale of 1 : 200000, on which the geological formations are shown with different colors and the positions of marked varieties of special economical substances are represented with conventional signs. The detailed maps of various scales are also produced according to the objects of the survey.

4. *Preparation and publication of explanatory texts etc.*—The explanatory text applying to each geological map is written in three chapters : the first treats of the topographical features of the districts ; the second gives the detailed description of rocks and different geological formations ; the third contains the description of the economic products. Many profiles, sections and maps are often annexed to the text. Besides there are published bulletins

in cooperation with other sections, which contain the results of investigation conducted by the Survey. All are written in Japanese.

5 *Museum.*—The specimens of rocks, minerals, ores, fossils etc. collected by the geological division are properly arranged together with geological maps and sections in the collecting room or museum. Among these, the specimens of technically important materials as ores, building or ornamental stones, whetstones, inkstones, clays etc. are particularly noticed under separate heads To the above are also annexed the specimens of typical Japanese soils collected by the agronomical section. They are arranged after physical classification and accompanied by a series of agronomical maps published by the Survey.

II. Agronomical Section.—The nature of the solid rocks of any land gives but slight effect to its agricultural conditions. It is the different characters of the weathered products of the solid rocks or *soils* which have great influence on the fertility of the agricultural land or region. The main points, therefore, to be studied in the agronomical survey in its relation to geology, are to divide the soils derived from various kinds of rocks into as many types as possible, and to judge therefrom the relative values or capabilities of these soils for cultivation. Hence the agronomical survey does not confine its labor only to the cultivated land, but also to that portion of the region capable of cultivation and also to the forest ground. The chief functions of the agronomical section are: 1. Field work. 2. Laboratory work. 3. Production and publication of maps. 4. Preparation and publication of explanatory texts.

1. *Field work.*—With reference to the geological map which has been prepared by the geological section, the agronomist is required to put on the field sketches (scale 1 : 50000.) the distribution of different soils, and at the same time the underground constructions of soils at any desired spots are examined with requisite instruments and their profiles are taken. The soils in their relation to mother rocks at different stages of weathering are also closely observed and the typical samples of soils and their respective mother rocks are collected with the following notices:

a. Geognostieal origin and petrographieal character of the soil.
b. Underground constructions of the soil to the depth of 3 meters, if possible.
c. Depth of the surface soil.
d. Situation of the land above sea level.
e. Configuration of the land.
f. Underground water level.
g. Local climatic conditions.
h. Classes of which the land value registered.
i. Judgement upon the conditions of actual farming.
j. Other agricultural particulars, such as the rotations and kinds of crops, manures, whether any melioration is adopted or not, etc.

The instruments useful in the agronomieal field work are: Boring stick. Piedmeter. Aneroid barometer. Thermometer. Sketching board with its requisites. Hammer. Spade etc.

2. *Laboratory work.*—The samples of soils collected in the field are investigated in the following ways:

a. *Mechanical composition.*—Every soil is quantitatively separated into thirteen parts according to the size of grains thus:—

1.	Size of grain larger than	10 mm.	in diameter		Gravels.
2.	„	„	10–8	„	
3.	„	„	8–6	„	
4.	„	„	6–4	„	
5.	„	„	4–3	„	Fine soil.
6.	„	„	3–2	„	
7.	„	„	2–1	„	
8.	„	„	1–0.5	„	
9.	„	„	0.5–0.25	„	Fine-earthy part.
10.	„	„	0.25–0.1	„	
11.	„	„	0.1–0.05	„	
12.	„	„	0.05–0.01	„	
13.	„	smaller than	0.01	—	

A sample of soil is first sifted through the meshes of a sieve 4 mm. in diameter and the *fine soil* thus separated is applied to the mechanical analysis—the analysis is conducted by Schöne's

apparatus—by which the soil particles from 11–13 are washed out one after another with the pressure of 0.2 mm., 2 mm. and 7 mm. velocity *per second.* The skeletons of soil remaining in the cylinder are separated by a set of sieves which have meshes with the respective diameters of 3, 2, 1, 0.5, 0.25 mm.

b. *Chemical constituent.*—For the chemical analysis, a sample of soil is treated with concentrated HCl (sp. gr. 1. 2) extraction method, by which the available constituents of soil can be well detected. Boiling the soil (fine-earthy part) with HCl for an hour and after passing through the usual operation, an extract is made from which Alumina, Iron Oxides (Ferric and Ferous), Manganic Oxide, Lime, Potash, Magnesia, Soda, Phosphoric Acid, Sulphuric Acid and Silica (soluble in HCl and Sodium Carbonate) are sucessively determined. Iron in ferous state is estimated by means of the *Copper method,*[1] and for the soil rich in humus, carbon and nitrogen are estimated, and in some cases chlorine is determined. In order to examine the character of clay and its content in the soil, an insoluble residue—left by treating the soil with HCl—is fluxed with H_2SO_4 and then the quantities of Al_2O_3 and SiO_2 contained in it are estimated.

c. *Physical properties.*[2]—About physical properties of the soil, we have to notice:

α. The weight of soil. Volume or absolute weight and specific gravity of the soil are estimated; and as the volume weight of the soil varies directly with its porosity, the weight of each sample of soils is ascertained either in a loose or a compact state.

β. Permeability of the soil to air and water. This important property is examined by ascertaining the water capacity and air contents of the soil, and in the process of experimenting we are able to observe the imbibing and capillary powers of soil.

d. *Absorptive power.*—To answer well the practical questions on manuring, the absorption of phosphoric acid and nitrogen in the soil must be examined. This may be effected, in the ordinary

[1] This method is fully described in 'Journal fur Landwirthschaft,' 1884, pp. 407–421, by Prof. Dr. M. Fesca.

[2] About the systematic method for experimenting on the physical properties of soil see Prof. Dr. M. Fesca's 'Abhandlungen und Erlaeurterung zur agronomische Karte Provinz Kai,' pp. 3–19.

way by means of the *Bottle method*, using as absorbents, monocalcium phosphate and sal ammoniac. However the use of the above absorbents has recently been found unstaisfactory, and at present, ammonium phosphate is employed. But about the adequate standard of the latter absorbent, the question still remains unsolved.

3. *Production and publication of maps.*—The topographical maps on the scale 1 : 100000, which have specially been prepared by the topographical section serve as a basis for the production of agronomical maps. They are separated into many divisional maps by the limits of administration boundaries (*Ken* or *Fu*), and each divisional map is known by the name of the provinces which it contains. The characters of soils and geological formations are represented on the map by the following cartographic signs:

a. Geological formations are delineated with different colors.
b. Characters of soils classified after physical conditions are shown with the inclined lines of different colors and crowded spots of various sizes in darker colors.
c. Underground constructions of soils to the depth of 3 meters are designated with many profiles (scale 1 : 100) on one side of the map, and their observed spots are noticed with corresponding Roman figures.
d. Those portions of lands represented by the inclined lines indicate both the cultivated and uncultivated lands (Hara), including in some cases the forest ground.

4. *Preparation and publication of explanatory texts.*—The explanatory texts are elaborated with the results obtained both in the field work and laboratory investigation. They are treated under 3 chapters: the first gives the description of topographical features of the district, with a special attention to the situation of the agricultural land and its advantages pertaining to transport, the second contains a general view of agricultural land or region with respect to its geological formations, and also a detailed account of soils investigated in the laboratory and of special mineral fertilizers; the third concludes with the discussion of soils as a factor for agriculture and their relations to plant growth, and finally the comparative fertility of soils in different geological formations.

III. Topographical Section.—The object of this section is to make the topographical maps upon which the geological and topographical features of the Empire can be properly represented with a reasonable degree of accuracy. The functions of this section are: 1. Field work. 2. Office work. 3. Production and publication of maps.

1. *Field work.*—The topographer is required to plot the field sheets on the scale of 1 : 50000. To accomplish the above task he is provided with perambulator, plane table with its requisites, pocket alt-azimuth instrument, mercurial and aneroid barometer. The distances are measured with perambulators; the topographical features are directly drawn upon the plane table sheets in the field; the heights of mountains etc. are measured with the alt-azimuth instruments and those of the routes with the barometers. The topographer makes from time to time the sketches of profile views of mountains or hills, when necessary. For special surveys, theodolite, level, magnetometer, sextant, and chronometer are used.

2. *Office work.*—The field sheets (scale 1 : 50000) are reduced and drawn on the scale of 1 : 100000 for reproduction of the special (scale 1 : 200000) or reconnaissance maps (scale 1 : 400000) and also of the agronomic maps (scale 1 : 100000). The heights are calculated from the altitude observations and barometrical readings. The astronomical and geodetic points in the maps and some other topographical informations are supplied from the data furnished by the trigonometrical survey of the War Department and also from the observations of the hydrographical survey under the Naval Department.

3. *Production and publication of maps.*—The topographical maps are published on two different scales, one on the scale of 1 : 200000, and other 1 : 400000. The former bears the name of special and the latter, reconnaissance maps. Both are constructed after the modified Flamsteed's projection. The middle meridian is laid down at 136° to the east of Greenwich and the middle parallel is 36° north latitude. Each of the special maps or sheets extends over one degree of longitude and half a degree of latitude; and it receives as a heading the name of the most important place as town, mountain etc., which it contains. The enumeration of the

sheets is made by a double table, with Roman figures in the horizontal and Arabic in the vertical columns. Contours are at equidistant curves of 40 meters. When finished, it will comprise 97 sheets (Hokkaidō and Loo choo Islands excluded). The reconnaissance maps are of 5 divisions, commencing from the north; each comprising 3 degrees of longitudes and 4 degrees of latitudes Contours are of 100 meters vertical intervals, excepting the division I on which they are at equidistant curves of 40 meters. The elevation of principal towns, mountains etc. is written and given in meters (no number given on contours). The various natural and artificial objects are illustrated by different conventional signs. The base is printed black, the water blue and the contour lines gray. Two scales are given below the border, one in kilometres and another in *ri*. The special and reconnaissance maps are published both in Japanese and English; and they are produced by lithography on stone. They together with geological and agronomical maps (accompanied by texts) may be purchased by the public.

IV. Chemical Section.—The object of the chemical section is to make the analysis of minerals and rocks and the assays of ores collected by the geological survey.[1] Besides the analytical investigation and experimental tests of such technically important materials as potters' clay, kaoline, brickearth, fire clay, lubricating oil, lime, cement, building stone etc., sent by the public are made, each analysis or test being however pursuant to a fixed tariff.

PROGRESS.

The progress or results of the works conducted by each section up to 1892 are briefly stated as follows :

I. Geological Section.—The reconnaissance survey of the whole of the Empire (except Hokkaidō) is completed, and more than one third of the entire area of the special survey sections or sheets (37 sheets out of 97) has been surveyed. There were issued

[1] Analysis of soils, mother rocks etc. are independently made in the agronomical laboratory belonging to the agronomical section.

26 sheets and all were accompanied by explanatory texts, save those of three sheets, viz., Osaka, Aizu and Ichinoseki. Those sheets in course of preparation are 11 in number, viz, Akita, Hiyeizan, Fukuoka, Toyooka, Ikuno, Miyazu, Noshiro, Kumamoto, Hamada, Honjō and Tobishima which will be published at the end of the next fiscal year. Out of 5 divisional maps of the reconnaissance survey, 3 have been published and the remaining 2 are in course of preparation.[1]

Besides the detailed surveys of the coal fields of Buzen and Chikuzen, of the oil lands of Yechigo and Tōtōmi, of Sado, Ikuno, Besshi, Ashio, Ani, Innai, Arakawa, Ōmori, Kamaishi and other important mines; of the raw materials of the Seto, Aizu, Banko and Shigaraki wares; of the sources of water supply of the towns of Sakai, Kumamoto, and the city of Tokyo; of the geological structure of the bay of Tokyo for the construction of a harbour; of the lands of Higo and Mino-Owari provinces shaken by the late severe earthquakes, of those portions of the provinces of Yamato and Awa (Shikoku) destroyed by the late landslips, and lastly of the district around Mt. Bandai devastated by the violent volcanic explosion of that mountain during the year 1888. The results of the above detailed surveys were made public either in bulletins or in special reports. The other works worthy of mentioning here are Dr. E. Naumann's 'Ueber den Bau und die entstehung der japanischen Inseln,' and Dr. T. Harada's 'Versuch einer geotektonischen gliederung der japanischen Inseln' and 'Die japanischen Inseln'

II. Agronomical Section.—As shown on the index map at the end of this paper, 27 prefectures extending over 48 provinces have been surveyed, of which 24 were finished and 3 are in progress. There have been issued agronomical maps of 12 prefectures (scale 1: 100000); of these 10 are accompanied by explanatory texts. Those maps in course of printing are 4 in number, viz., Hiroshima, Tottori, Ishikawa and Iwate; and explanatory texts of the first three will be published at the end of this fiscal year.

As a special work, the relations of the principal agricultural

[1] For particulars see index map at the end of this paper.

products to some of the important facts in regard to the local conditions have been studied in different parts of the Empire. As the results of the above study have given useful informations about the scientific and economical questions involved both in the agricultural lands and the production of plants, Prof. Dr. M. Fesca with some of the agronomists of the section were engaged in the above work from the years 1886–1891; during that time they made practical observations in the different parts of the Empire and Prof. Dr. Fesca issued 'Beiträge zur Kenntniss der japanischen Landwirthschaft' and 'Ueber die Landwirth schaftlichen verhaltnisse Japan's und die Kolonization Hokkaidō's' etc. as the results of the above work.

III. Topographical Section.—The field work of the topographical section has been conducted so as to advance one step earlier than that of the geological section. Accordingly the number of the sheets already surveyed is greater than that made by the geological field work. Out of 97 sheets, the surveys of 53 have been finished. There have been issued 29 sheets, and those in course of preparation or publication are 6 in number, viz., Ikuno, Miyazu, Toyooka, Noshiro, Hamada and Kumamoto. The reconnaissance maps hitherto published are 4, and the remaining 1 is in course of preparation.[1]

Besides magnetic observations were carried out over the Main Island (Honshiu), Shikoku and Kyushiu during the years 1882–1883. The stations of the magnetic observations thus made are:

In the Main Island	119.
„ Kyushiu	30.
„ Shikoku	17.
„ Sado	3.
Total	169.

IV. Chemical Section.—The results of analysis of rocks, minerals and other useful substances sent by the geological section were mentioned in the explanatory texts accompanying geological maps and also in bulletins, while those of the analytical investigation and experimental tests conducted by the chemical laboratory

[1] For particulars see index map at the end of this paper.

were made public in special reports. The following are some of the important subjects found in the contents of the above reports: on the Japanese fire clays; on the analysis of more than 700 specimens of Japanese coals; limestones; Portland Cements; indigoes; lacquer; lubricating oils, etc.

Lastly we must not forget to mention here that at the World's Exposition in Paris, 1889, the Geological Survey received *gold and silver medals* for a series of geological, agronomical and topographical maps exhibited there.

PERSONNEL OF THE GEOLOGICAL SURVEY.

Director:

Tsunashirō Wada.

Inspector of the geological and topographical surveys:

Toyokitsi Harada, Dr. Phil., *Rigakuhakushi.*
(*Retired from service on account of bodily weakness in* 1891).

Adviser of the agronomical survey:

Max Fesca, Prof., Dr. Phil.

Chief of the geological section:

Tadatsugu Kochibe, *Rigakuhakushi.*

Chief of the agronomical section:

Noritaka Tsunetō.

Chief of the topographical section:

Shūzō Sekino.

Chief of the chemical section:

Jintarō Takayama, *Rigakuhakushi.*

Geologists:

K. Nakashima.
D. Yamashita.
S. Ōtsuka.
T. Suzuki.
S. Miura.

Agronomists :

H. Watanabe.
M. Kamoshita.
F. Kobayashi.
G. Hayakawa.
S. Shinjō.
M. Matsuoka.
B. Minari.
T. Yamanaka.
H. Tōjō.

Topographers :

M. Ōkawa.
Y. Horiuchi.
T. Nakamura.

Chemists :

K. Kondō.
E. Hirao.
K. Kajiura.
Y. Kitamura.
T. Tamura.
K. Sekiguchi
N. Ōsumi.
S. Nagai.

Ten *Cartographers* and many subordinate assistants are employed.

Each geologist and agronomist works individually a given area, guided by his skill and experience. One geologist can survey one sheet in about 4 months which is the time alloted for the field work during a year. As the area of each agronomical division differs in different ones, their extent being limited by the boundaries of *Ken* or *Fu* (Prefectures), the annual field work of each agronomist has not been exactly measured, but he can survey on an average the area of one prefecture in 2 years, 4 months being spent for the field work during a year. These professional geologists and agronomists are regularly in the employ of the Survey and are employed from the graduates of the Imperial University (the Teikoku Daigaku).

APPENDIX.

A SHORT TREATISE ON THE GEOLOGICAL AND TOPOGRAPHICAL SURVEYS OF HOKKAIDŌ.

As has already been mentioned, the geological and topographical surveys of Hokkaidō have been conducted independently by the Hokkaidōchō, but their methods of surveying are in full accordance with those adopted by the geological and topographical sections of the Survey. The following is a short summary of the geological and topographical surveys hitherto made in Hokkaidō.[1]

The islands known as Hokkaidō are situated in the northern part of the Japanese Empire. They consist of the two special divisions, viz., (1) a large island of a somewhat ray-fish-shaped nature called, till quite recently, 'Yesso' by foreigners, and (2) the Chishima Group hitherto known as the 'Kurile Islands.' Besides these, however, there are many other smaller islands about the coast of the main or larger division, i.e. 'Yesso.' The total area is estimated at about 5960 sq. *ri*, (1 sq. *ri*=6.25 sq. miles). Hokkaidō extends from 139° 13′ to 156° 34′ E. Long and 41° 23′ 10″ to 51° 56′ N. Lat.

Topographical Survey.—The earliest land-survey done in Hokkaidō was carried out by Mr. T. Inō, a well-known Japanese surveyor. His work was, however, quite limited in extent. A further systematic survey by Lieutenant Day and others was begun in the year 1874 but unfortunately was not continued more than three years. Finally in the year 1886, the topographical survey of Hokkaidō was again entered upon and the work then commenced has been steadily pursued till at length the reconnaissance survey

[1] Transcribed mainly from a paper kindly furnished to the Survey by Mr. K. Jimbō, the late chief geologist to the Hokkaidōchō.

has, with the exeeption of the Chishima Group and some of the smaller islands, been finished. A more detailed survey has of late been proseeuted in the provinces of Tokaehi, Hidaka, Iburi, Oshima and Shiribeshi (i.e. nearly half the area of the largest island); and more than ten detailed maps on the scale of 1 : 200000 have been published.

Geological Survey.—After Lyman's work the geological survey of Hokkaidō was suspended for thirteen years, till 1888; in that year work was reeommenced and Mr. K. Jimbō was appointed as chief geologist. During the first four years (1888–1891), Mr. Jimbō and his colleagues finished their preliminary traverses through the islands in different direetions.[1] These men traversed all the islands exeepting those lying to the N.E. of the island of Urup in the Chishima Group. The results of their four years' work have already been published[2] and the above observers are now engaged in more detailed explorations in those regions where new localities of useful minerals are, it is thought, likely to be diseovered.

[1] Their routes are shown in the Mountain System Map of Hokkaidō (1892).

[2] See Jimbō's General Geological Sketch of Hokkaidō, his Geological Map, and his report written in Japanese (all published in 1892).

A

CATALOGUE OF ARTICLES

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CATALOGUE OF THE EXHIBITS.

(1). MAPS.

Geological map of the Japanese Empire (Scale 1 : 1,000,000).
Reconnaissance geological maps (Scale 1 : 400,000) :

Division II,
,, III.

Special geological maps (Scale 1 : 200,000) :

Section Kazusa,
,, Yokohama,
,, Shizuoka,
,, Tōkyo,
,, Maebashi,
,, Kōfu,
,, Ueda,
,, Fuji,
,, Nagano,
,, Nikkō,
,, Kitsuregawa,
,, Toyohashi,
,, Yokkaichi,
,, Sado,
,, Shirakawa,
,, Nagoya,
,, Asuke,
,, Toyama,
,, Ishinomaki.

Agronomical maps (Scale 1 : 100,000) :

Kai,
Sagami and the southern part of Musashi,
Shimotsuke (eastern part),

Iwashiro and the southern part of Iwaki,
Kozuke,
Higo.

Map showing the progress of the geological survey of Japan up to and including 1892.

Map showing the progress of the agronomical survey of Japan up to 1892.

Geological map of Hokkaido (Scale 1: 1,500,000).

Topographical map of Hokkaidō with localities of useful minerals (Scale 1: 1,500,000).

(2). EXPLANATORY TEXTS, BULLETINS, REPORTS, ETC.

Explanatory text to the geological map of
Section Kazusa, (in Japanese),
„ Yokohama, „
„ Shizuoka, „
„ Tōkyo, „
„ Maebashi, „
„ Kōfu, „
„ Ueda, „
„ Fuji, „
„ Nagano, „
„ Nikko, „
„ Kitsuregawa, „
„ Toyohashi, „
„ Yokkaichi, „
„ Sado, „
„ Shirakawa, „
„ Nagoya, „
„ Asuke, „
„ Toyama, „
„ Ishinomaki, „

Explanatory text to the agronomical map of
Kai (both in Japanese and German),
Sagami and the southern part of Musashi (in Japanese),
Shimotsuke (eastern part; in Japanese),
Iwashiro and the southern part of Iwaki (in Japanese),
Kodzuke (in Japanese),
Higo ,,

Bulletins of the Geological Survey of Japan (in Japanese): 1881-1884, 6 vol., 1887-1892, 5 vol.

Versuch einer Geotektonischen gliederung der japanischen Inseln von Dr. Toyokitsi Harada.

Die japanischen Inseln von Dr. Toyokitsi Harada, Erste Lieferung mit 5 kartenbeilagen.

Explanatory text to the geological map of Hokkaidō by K. Jimbō (in English).

General geological sketch of Hokkaidō with special reference to the petrography by K. Jimbō (in English).

Beitrage zur Kenntniss der japanischen Landwirthschaft von Prof. Dr. Max Fesca mit einen Atlas und 23 Karten

Ueber die Landwirthschaftlichen verhaltnisse Japan's und die kolonization Hokkaidō's von Prof. Dr. M. Fesca.

(3). MINERALS.

The specimens, here exhibited, include nearly all the mineral species so far as found in our country. They are classified according to Naumann's system with their corresponding localities as follows:—

I. ELEMENTS.

1.	**Graphite.**	*Kataura, Satsuma.*
2.	„	*Kawai, Hida.*
3.	**Prismatic Sulphur.**	*Asamayama, Shinano.*
4.	**Native Sulphur.**	*Atosanobori, Kushiro.*
5.	**Native Bismuth.**	*Ikuno, Tajima.*
6.	**Native Copper.**	*Ozaruzawa, Rikuchiū.*
7.	**Native Mercury in Sandy-tuff.**	*Yamaguchi, Hizen.*
8.	**Native Silver.**	*Ikuno, Tajima.*
9.	**Native Gold.**	*Yamagano, Ōsumi.*
10.	**Native Gold in Argentite.**	*Takatama, Iwashiro.*
11.	**Alluvial Gold.**	*Yamashirodani, Awa (Shikoku).*

II. SULPHIDES.

12.	**Iron pyrites.**	*Udō, Izumo.*
13.	„ „	*Zenego, Ugo.*
14.	„ „	*Fukui, Hōki.*
15.	**Iron pyrites on Rock Crystal.**	*Ani, Ugo.*
16.	**Mispickel.**	*Obira, Bungo.*
17.	**Pyrrhotite.**	*Sakamoto, Bitchiū.*
18.	**Galena.**	*Ani, Ugo.*
19.	**Galena and Quartz on Chalcopyrite.**	„ „
20.	**Argentite.**	*Ikuno, Tajima.*
21.	„	*Aikawa, Sado,*
22.	**Zincblende.**	*Ani, Ugo.*
23.	**Chalcopyrite.**	„ „
24.	**Chalcopyrite on Rock Crystal.**	„ „
25.	**Bornite.**	*Ōmori, Iwami.*
26.	**Cinnabar.**	*Komagaeri, Yamato.*

27.	**Molybdenite.**	*Shirakawa, Hida.*
28.	**Realger.**	*Monji, Rikuzen.*
29.	**Orpiment.**	*Jōzankei, Ishikari.*
30.	**Stibnite.**	*Oshōin, Iyo.*
31.	**Ruby Silver.**	*Innai, Ugo.*
32.	**Tetrahedrite.**	*Ikuno, Tajima.*
33.	**Fahl ore.**	*„ „*
34.	**Stephanite.**	*Innai, Ugo.*

III. OXIDES.

35.	**Cuprite.**	*Arakawa, Ugo.*
36.	**Sapphire.**	*Nakatsugawa, Mino.*
37.	**Hematite.**	*Matsuo, Hiuga.*
38.	**Hematite (Micaceous Iron).**	*Semnin, Rikuchū.*
39.	**Rock Crystal.**	*Kashirazutoi, Awa (Shikoku).*
40.	**„ „**	*Narushima (Gotō), Hizen.*
41.	**Smoky Quartz.**	*Sekinotsu, Ōmi.*
42.	**Amethyst.**	*Ohara, Iwaki.*
43.	**Ferruginous Quartz.**	*Near Hanawa, Rikuchiū.*
44.	**Jasper.**	*Tamatsukuri, Izumo.*
45.	**Chalcedony.**	*Onishi, Yetchiū.*
46.	**„**	*Okunimachi, Uzen.*
47.	**Agate.**	*Nishihara, Yetchiū.*
48.	**Opal.**	*Bodai, Kaga.*
49.	**„**	*Yashiki, Iwashiro.*
50.	**Wood Opal.**	*Innai, Ugo.*
51.	**Hyalite.**	*Near Ōmachi, Shinano.*
52.	**Cassiterite.**	*Nakatsugawa, Mino.*
53.	**Chromite.**	*Washidani, Bungo.*
54.	**Magnetite.**	*Kamaishi, Rikuchiū.*
55.	**Manganite.**	*Numadate, Ugo.*
56.	**Limonite.**	*Nagaoka, Ugo.*
57.	**„**	*Takamatsu, Ugo.*
58.	**Psilomelane.**	*Yagi, Tamba.*
59.	**Impure Asbolite.**	*Akatsu, Owari.*

IV. HALOID SALTS.

60.	**Fluorite.**	*Obira, Bungo.*
61.	,,	*Omodani, Yechizen.*

V. OXYSALTS.

62.	**Calcite.**	*Akasaka, Mino.*
63.	,,	*Ani, Ugo.*
64.	**Calcite after Barytes.**	*Aikawa, Sado.*
65.	**Magnesite.**	*Arakawa, Ugo.*
66.	**Siderite with Galena on Andesite.**	*Ōmori, Iwami.*
67.	**Siderite.**	*Uchinokuchiyama, Bungo.*
68.	**Rhodochrosite.**	*Ponshikaribetsu, Shiribeshi.*
69.	,,	*Kuradani, Kaga.*
70.	**Aragonite.**	*Taira, Shinano.*
71.	**Schaumkalk.**	*Myōkenzan, Harima.*
72.	**Cerussite.**	*Ozaruzawa, Rikuchiū.*
73.	**Azurite and Malachite.**	*Tada, Settsu.*
74.	**Malachite with Azurite.**	*Arakawa, Ugo.*
75.	**Barytes on Galena and Iron pyrites.**	*Kuradnai, Kaga.*
76.	**Barytes.**	*Ozaruzawa, Rikuchiū.*
77.	,,	*Ponshikaribetsu, Shiribeshi.*
78.	**Anglesite and Cerussite on Galena.**	*Ōtori, Uzen.*
79.	**Gypsum.**	*Yuda, Rikuchiū.*
80.	**Alabaster.**	*Arakura, Kai.*
81.	**Wolfram.**	*Naeki, Mino.*
82.	**Apatite.**	*Hachimanyama, Kai.*
83.	**Chiastolite in Clay Slate.**	*Usuginn, Rikuchiū.*
84.	**Pyromorphite and Cerussite.**	*Ozaruzawa, Rikuchiū.*

85.	Topaz.	*Otaniyama, Ōmi.*
86.	„	*Nakatsugawa, Mino.*
87.	„	„ „
88.	Tourmaline.	*Near Kimpōzan, Kai.*
89.	„	*Yokogawa, Hitachi.*
90.	„	*Obira, Bungo.*
91.	Vesuvian.	„ „
92.	Epidote.	*Kamaishi, Rikuchiū.*
93.	Olivine in Basalt.	*Ōgusoyama, Iwami.*
94.	Calamine.	*Kamioka, Hida.*
95.	Ilvaite.	*Zōmeki, Nagato.*
96.	Chrysocolla.	*Kamioka, Hida.*
97.	Garnet.	*Wadatōge, Shinano.*
98.	Garnet Sand.	*Anamushi, Yamato.*
99.	Axinite.	*Obira, Bungo.*
100.	Musovite with Smoky Quartz.	*Sekinotsu, Ōmi.*
101.	Biotite.	„ „
102.	Agalmatolite.	*Mitsuishi, Bizen.*
103.	Wollastonite.	*Ishiyama, Ōmi.*
104.	Augite.	*Yoshida, Hizen.*
105.	Hedenbergite.	*Obira, Bungo.*
106.	Hornblende.	*Kiura, Bungo.*
107.	Rhodonite.	*Ōno, Yamato.*
108.	Cordierite in Clay Slate.	*Gōdo, Kōzuke.*
109.	Cordierite (Pinite).	*Torihama, Wakasa.*
110.	Beryl.	*Naeki, Mino.*
111.	Chabazite.	*Akadani, Kōzuke.*
112.	Stilbite and Apophyllite.	*Hatsuneura, Ogasawarajima (Bonin Island).*
113.	Stilbite.	„ „
114.	Analcime.	*Mase, Yechigo.*
115.	Orthoclase.	*Sekinotsu, Omi.*
116.	Orthoclase with Smoky Quartz.	*Akazu, Owari.*
117.	Albite in Chlorite Schist.	*Bésshi, Iyo.*

118. **Anorthite.** *Kamitsuki (Miyakejima), Izu.*

VI. ORGANIC COMPOUNDS.

119. **Anthracite.** *Miyai, Kii.*
120. **Bituminous Coal.** *Komatsuura, Buzen.*
121. **Brown Coal.** *Akadani, Yechigo.*
122. **Natural Coke.** *Yamada, Chikuzen.*
123. **Peat.** *Tanemori, Ugo.*
124. **Asphaltum.** *Tsukinoki, Ugo.*
125. **Amber.** *Ōkawame, Rikuchiu.*

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(4). ROCKS.

The specimens of rocks, here exhibited, include most of the typical ones found in our country. They serve to illustrate many of the rocks described by Dr. T. Harada in his 'Die japanischen Inseln,'[1] and they are arranged according to their geological formations with their corresponding localities as follows :—

A. METAMORPHIC ROCKS.

I. ARCHÆAN.

1. *Gneiss System.*

126. **Kashio-gneiss.** *Kashio, Shinano.*
127. „ *Yōkaichi, Shinano.*
128. **Biotite-gneiss.** *Ōkawara, Shinano.*
129. **Biotite Schist.** *Shioda, Awaji.*

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[1] Part II. is in course of preparation.

130.	**Rioke Mica-schist.**	*Katsuma, Shinano.*
131.	„ „	*Matsukawa, Iwaki.*
132.	„ „	*Tōyamagawa, Shinano.*
133.	**Hornblende-gneiss.**	*Near Takatō Shinano.*
134.	**Amphibolite-gneiss.**	*Ishizumi, Iwaki.*
135.	**Amphibolite.**	*Near Irishiken, Hitachi.*
136.	**Augen-gneiss.**	*Near Takatō, Shinano.*
137.	**Granitic Gneiss.**	*Matsukawa, Iwaki.*
138.	„ „	*Irishiken, Hitachi.*
139.	„ „	*Near Iijima, Shinano.*
140.	**Eclogite Rock.**	*Katsuma, Shinano.*
141.	**Limestone.**	*Ōsogura, Shinano.*

2. *Crystalline Schist System.*

142.	**Sericite-schist.**	*Sueno, Musashi.*
143.	„	*Ōtakisan, Awa (Shikoku).*
144.	„	„ „ „
145.	„	*Besshi, Iyo.*
146.	**Mica-schist.**	*Near Besshi, Iyo.*
147.	„	*Ōtakisan, Awa (Shikoku).*
148.	**Piedmontite-schist.**	„ „ „
149.	„	*Nogami, Musashi.*
150.	**Glaucophane-schist.**	*Ōtakisan, Awa (Shikoku).*
151.	„	„ „ „
152.	**Spotted Grâphite-schist.**	*Sambagawa, Musashi.*
153.	**Spotted Sericite-schist.**	*Nushima, Awaji.*
154.	„ „	*Besshi, Iyo.*
155.	**Spotted Graphite-sericite-schist.**	„ „
156.	„ „	„ „
157.	**Spotted Chlorite-schist.**	„ „
158.	„ „	„ „
159.	„ „	*Ōtakisan, Awa (Shikoku).*
160.	„ „	„ „ „
161.	„ „	*Sambagawa, Musashi.*
162.	**Epidote Sericite-gneiss.**	*Near Minano, Musashi.*

B. SEDIMENTARY ROCKS.

I. PALÆOZOIC.

1. *Chichibu System.*

163.	**Pyroxenite.**	*Yuzurihara, Kōzuke.*
164.	,,	*Near Kanazawatōge, Shinano.*
165.	**Pyroxenite (Serpentinized).**	*Yuzurihara, Kōzuke.*
166.	**Pyroxene-amphibolite.**	*Gozaisho, Iwaki.*
167.	**Quartzite (Between Pyroxenite).**	*Machiya, Hitachi.*
168.	**Limestone (Between Pyroxenite).**	*Yuzurihara, Kōzuke.*
169.	,,	*Mayumi, Hitachi.*
170.	**Platy Quartzite.**	*Sakahara, Kōzuke.*
171.	**Variegated Quartzite.**	,, ,,
172.	**Quartzite.**	*Kanazawatōge, Shinano.*
173.	**Adinole-slate.**	*Sakahara, Kōzuke.*
174.	,,	,, ,,
175.	**Lower Schalstein.**	,, ,,
176.	,, ,,	*Near Mamba, Kōzuke.*
177.	**Lower Schalstein.**	*Ashigakubo, Musashi.*
178.	**Brecciated Schalstein.**	,, ,,
179.	**Lower Limestone.**	*Sakahara, Kōzuke.*
180.	**Sandstone.**	*Kosuge, Kai.*
181.	,, **(Metamorphosed).**	*Hanawa, Kōzuke.*
182.	,, ,,	*Mori, Suruga.*
183.	,, ,,	*Oui, Yechigo.*
184.	**Clay Slate.**	*Yahagi, Rikuchiū.*
185.	**Fucoidal Clay Slate.**	*Inamata, Kai.*
186.	**Clay Slate.**	*Ashio, Shimotsuke.*
187.	**Lower Schalstein.**	*Sakahara, Kōzuke.*
188.	**Clay Slate.**	*Nishiminowa, Shinano.*
189.	,, ,,	*Asamizu, Musashi.*

190.	Clay Slate.	*Kashi, Mimasaku.*
191.	„	*Kanegawa, Rikuchiū.*
192.	Conglomerate.	*Kamiarusu, Rikuzen.*
193.	Variegated Schalstein.	*Iitani, Awa (Shikoku).*
194.	Hornstone.	*Minamigawa, Mimasaku.*
195.	Quartzite.	*Ashigakubo, Musashi.*
196.	Radiolarian Slate.	*Tabayama, Kai.*
197.	Amygdaloidal Schalstein.	*Near Tanano, Awa (Shikoku).*
198.	„	*Ōnoichi, Bungo.*
199.	Crinoidal Limestone.	*Akasaka, Mino.*
200.	„ „	*Matsukawa, Rikuchiū.*
201.	Fusulina Limestone.	*Akasaka, Mino.*
202.	„ „	„ „

2. *Kobotoke System.*

203.	Clay Slate.	*Near Kobotoke, Sagami.*
204.	„ „	*Ōtarumi, Sagami.*
205.	Adinole-slate.	„ „
206.	Sandstone.	*Near Kobotoke, Sagami.*

II. MESOZOIC.

1. *Triassic.*

207.	Sandstone.	*Yamanoi, Nagato.*
208.	Conglomerate.	*Near Yamanoi, Nagato.*
209.	Fossiliferous Shale.	*Yamanoi, Nagato.*
210.	Shale (with Ammonite).	*Inai, Rikuzen.*
211.	Monotis Shale.	*Izatomae, Rikuzen.*

2. *Jurassic.*

212.	Cyrena Shale.	*Ushimaru, Hida.*
213.	Podozamites Shale.	*Okamigō, Hida.*
214.	Clay Slate.	*Okatsu, Rikuzen.*
215.	Limestone.	*Itsukaichi, Musashi.*

3. *Cretaceous.*

216.	**Trigonia Sandstone.**	***Ryōseki, Tosa.***
217.	**Izumi Sandstone.**	***Fukui, Awaji.***
218.	**Conglomerate.**	***Tanano, Awa (Shikoku).***
219.	**Misaka Brecciated-tuff.**	***Misakatōge, Kai.***
220.	**Misaka Shale.**	***Near Mikanitōge, Yechigo.***
221.	**Conglomerate.**	***Wadatōge, Shinano.***

4. *Mesozoic Rocks of Unknown Period.*

222.	**Shalestein (with Pentacrinus).**	***Aobama, Buzen.***
223.	**Conglomerate.**	***Ōtsumi, Buzen.***
224.	**Quartz Porphyry-tuff.**	***Hozawa, Iwashiro.***
225.	**Metamorphosed Tuff.**	***Near Shimonoseki, Nagato.***

III. CAINOZOIC.

1. *Tertiary.*

226.	**Fossiliferous Sandstone.**	***Sukegawa, Hitachi.***
227.	**Turritella Sandstone.**	***Torinosu, Kii.***
228.	**Fossiliferous Sandstone.**	***Yuya, Izumo.***
229.	**Sandstone.**	***Nishinohara, Kii.***
230.	,,	***Meinohama, Chikuzen.***
231.	,,	***Inuboezaki, Shinano.***
232.	,,	***Takenokojima, Nagato.***
233.	,,	***Ōmori, Iwami.***
234.	,,	***Ozone, Suruga.***
235.	**Tuff-sandstone.**	***Obanachi, Yechigo.***
236.	,,	***Iida, Musashi.***
237.	**Conglomerate.**	***Ikusaka, Shinano.***
238.	,,	***Mizunoue, Chikuzen.***
239.	**Fossiliferous Marl.**	***Azuhata, Hitachi.***
240.	**Fossiliferous Sandy Shale.**	***Ogoya, Kaga.***
241.	**Shale.**	***Innai, Ugo.***

242.	**Tuff Shale.**	*Shiobara, Shinano.*
243.	„ „	*Hodozawa, Musashi.*
244.	„ „	*Miyada, Hitachi.*
245.	**Pumice Breccia.**	*Innai, Ugo.*
246.	„ „	*Yoshida, Rikuzen.*
247.	**Tuff Breccia.**	*Kawafune, Rikuchiū.*
248.	„ „	*Yomotsu, Kai.*
249.	„ „	*Iiidegawa, Sagami.*
250.	„ „	*Kamo, Izu.*
251.	**Brecciated Tuff.**	*Yamadome, Suruga.*
252.	**Tuff.**	*Shimoshiobara, Shimotsuke.*
253.	**Liparite Tuff.**	*Kanagase, Tajima.*
354.	**Diatom Earth.**	*Abashiri, Kitami.*

2. *Quaternary.*

255.	**Loam.**	*Tōkyō, Musashi.*
256.	**Sand.**	„ „
257.	**Loose Conglomerate.**	„ „
258.	**Clay.**	„ „

C. ERUPTIVE ROCKS.

I. PALÆO-ERUPTIVE ROCKS.

259.	**Biotite-granite.**	*Mikage, Settsu.*
260.	„	*Shōdoshima, Sanuki.*
261.	„	*Near Ashio, Shimotsuke.*
262.	„	*Iwakuzure, Yechigo.*
263.	**Muscovite-granite.**	*Tsukubasan, Hitachi.*
264.	„	*Aoki, Chikuzen.*
265.	**Tourmaline-granite.**	*Katsuma, Shinano.*
266.	**Hornblende-granite.**	*Yuon, Rikuzen.*
267.	„	*Kuroda, Buzen.*
268.	**Porphyritic-granite.**	*Shimotama, Nagato.*
269.	„	*Odaira, Yechigo.*
270.	**Granite-porphyry.**	*Yanaba, Shinano.*

271.	Granite-porphyry (Microgranite).	*Kotsutōge, Kii.*
272.	,,	*Shio, Awaji.*
273.	Quartz-porphyry (Microgranite).	*Nachi, Kii.*
274.	Quartz-porphyry.	*Shirakawamada, Yamato.*
275.	,,	*Teraoyama, Hida.*
276.	,,	*Kiyomi, Hida.*
277.	,,	*Kuromori, Iwashiro.*
278.	,,	*Near Shinichi, Bingo.*
279.	,,	*Nishiune, Harima.*
280.	,,	*Nakashiobara, Shimotsuke.*
281.	,,	*Takami, Iwami.*
282.	,,	*Nikkō, Shimotsuke.*
283.	,,	*Near Kawakami, Ōmi.*
284.	,,	*Takinoyu, Shimotsuke.*
285.	,,	*Nikkō, Shimotsuke.*
286.	Diorite.	*Akaidake, Iwaki.*
287.	Quartz-diorite.	*Tatsuzawa, Kai.*
288.	,,	*Tajima, Iwashiro.*
289.	Gabbro Diorite.	*Near Minano, Musashi.*
290.	Gabbro.	*Mineokayama, Awa.*
291.	Peridotite.	*Machiya, Hitachi.*
292.	Ophi-calcite.	*Minano, Musashi.*
293.	Serpentine.	*Okuda, Iwaki.*
294.	Diabase.	*Misakatōge, Kai.*
295.	,,	*Aramachi, Shinano.*
296.	Diorite-porphyrite.	*Shimonoseki, Nagato.*
297.	,,	*Ushimaru, Hida.*
298.	Diabase-porphyrite.	*Kamaishi, Rikuchiū.*
299.	,,	*Wadatōge, Kai.*
300.	,,	*Misakatōge, Kai.*
301.	,,	*Kamitano, Kai.*

II. NEO-ERUPTIVE ROCKS.

302.	Liparite.	*Tokukōyama, Shinano.*
303.	,,	*Near Ikuno, Tajima.*

304.	Liparite.	*Obekkaushi, Ishikari.*
305.	„	*Jōzankei, Ishikari.*
306.	Obsidian.	*Kimpōzan, Oki.*
307.	„	*Kunimi, Kaga.*
308.	Brecciated-obsidian.	*Wadatōge, Shinano.*
309.	Perlite.	*Kurokami, Hizen.*
310.	„	*Yamabe, Yamato.*
311.	Pumice.	*Kumamoto, Higo.*
312.	Dacite.	*Horikiri (Near Ganjusan), Rikuchiū.*
313.	Quartz-mica-andesite.	*Usuda, Yechigo.*
314.	„	*Yamabe, Yamato.*
315.	Propylite.	*Okuyama, Tajima.*
316.	„	*Ani, Ugo.*
317.	Pyroxene-andesite.	*Mumagaeshi (Nikkō), Shimotsuke.*
318.	„	*Shimotsutaki, Shinano.*
319.	„	*Miyatoko, Rikuzen.*
320.	„	*Iwamoto, Kōzuke.*
321.	„	*Suwa, Shinano.*
322.	„	*Komagatake (Hakone), Sagami.*
323.	„	*Ōmori, Iwami.*
324.	Andesite.	*Akiyama, Kai.*
325.	Pyroxene-andesite.	*Near Yoshino, Sagami.*
326.	Quartz-mica-pyroxene-andesite.	*Matsuno, Izu.*
327.	Pyroxene-andesite.	*Nishi-ōno, Bungo.*
328.	Asama Lava (Pyroxene-andesite-glass).	*Asamayama, Shinano.*
329.	Aso Lava (Quartz-pyroxene-andesite).	*Kurokawa, Higo.*
330.	Sanukite.	*Kokubu, Sanuki.*
331.	Asama Bomb (Cordierite-lava).	*Asamayama, Shinano.*
332.	Mud Lava.	*Nakahebaru, Chikugo.*
333.	„	*Takeda, Bungo.*

334. Hornblende-andesite. *Shiosawa, Shinano.*
335. „ *Kōga, Chikuzen.*
336. „ *Fujisawa, Yechigo.*
337. „ *Kamasawa, Yechigo.*
338. Basalt. *Shimonoseki, Nagato.*
339. „ *Ōgusoyama, Iwami.*
340. Fuji Lava (Basalt). *Fuji, Suruga.*
341. „ „ „
342. Basalt. *Saigō, Oki.*

(5). FOSSILS.

Our fossils are rather poor and not well studied. The following are, however, some of the characteristic fossils arranged according to their geological formations with their corresponding localities :—

I. PALÆOZOIC.

1. *Upper Chichibu Series.*

(Sub-carboniferous).

343. Schwagerina sp. *Akasaka, Mino.*
344. Fusulina sp. „ „
345. Bellerophon sp. „ „
346. Pleurotomaria sp. *Maiya, Rikuzen.*
347. Rhynchonella sp. *Yakeijima, Rikuzen.*
348. Trilobite (Phillipsia sp.?) *Arisu, Rikuzen.*
349. Favosites sp. *Tsukitate, Rikuzen.*

II. MESOZOIC.

1. *Triassic.*

350. Pseudomonotis ochotica (*Keyserl*) *Teller.* *Naviwa, Bitchiū.*
351. Daonella Sakawana, *E. v. Mojs.* *Sakawa, Tosa.*

352. **Arpadites Gottschei** *E.v. Mojs.* — *Near Ishinomaki, Rikuzen.*
353. **Dictyophyllum japonicum** *Yok.* — *Yamanoi, Nagato.*

2. *Jurassic.*

354. **Perisphinctes sp.** — *Nagano, Yechigo.*
355. **Cyrena (Corbicula sp.).** — *Kagahara, Kōzuke.*
356. **Thamnastræa sp.** — *Shiraishi, Tosa.*
357. **Pecopteris cfr. Browniana** *Dk.* — *Tanano, Awa, (Shikoku).*
358. **Pecopteris Geyleriana** *Nath.* — *Ryōseki, Tosa.*
359. **Pecopteris exilis** *Phill.* — *Shima, Kaga.*
360. **Asplenium whitbyense** *Brgt.* — *Ryōseki, Tosa.*
361. **Onychiopsis elongata** *Geyl.* — *Tanano, Awa, (Shikoku).*
362. **Nilssonia nipponensis** *Yok.* — *Okamigō, Hida.*
363. **Nilssonia cfr. schaumburgensis** *Dkr.* — *Ryōseki, Tosa.*
364. **Zamiophyllum Buchianum** *Ett.* — „ „
365. **Podozamites lanceolatus** *Lind.* — *Shima, Kaga.*
366. **Dictyozamites indicus** *Feistm.* var. distans. — *Ozō, Kaga.*
367. **Ginkgodium Nathorsti** *Yok.* — *Shima, Kaga.*
368. **Gingko digitata** *Bryt.* — *Okamigō, Hida.*

3. *Cretaceous.*

369. **Phylloceras sp.** — *Yūbarigawa, Ishikari.*
370. **Lytoceras Sacya** *Forbes.* — „ „

371. **Pachydiscus Naumanni** *Yok.* — *Yūbarigawa, Ishikari.*
372. **Desmoceras Gaudama** *Forbes.* — ,, ,,
373. **Ptychoceras pseudogualtinum** *Yok.* — *Urakawa, Hidaka.*
374. **Inoceramus Naumanni** *Yok.* — ,, ,,
375. **Trigonia pocilliformis** *Yok.* — *Tanano, Awa (Shikoku).*

III. CAINOZOIC.

1. *Tertiary.*

376. **Spatangus** sp. — *Miyada, Hitachi.*
377. **Odostomia planata** *Gould.* — *Ōji, Musashi.*
378. **Nassa japonica** *Adams.* — ,, ,,
379. **Ringicula arctata** *Gould.* — ,, ,,
380. **Natica Lamarckiana** *Recluz.* — ,, ,,
381. **Pectunculus glycimeris** *L.* — ,, ,,
382. **Nucula Cobboldiae** *Sow.* — ,, ,,
383. **Dosinia Exoleta** *L.* — ,, ,,
384. **Tellina nasuta** *Conr.* — ,, ,,
385. **Pliocene Foraminifera.** — *Koshiba, Musashi.*
386. **Acer pictum** *Thumb.* — *Shiobara, Shimotsuke.*
387. **Planera Ungeri** *Ett.* — *Ani, Ugo.*
388. **Comptoniphyllum japonicum** *Nath.* — *Tarakawa, Tosa.*
389. **Trapa Yokoyama** *n.* sp. — *Ogoya, Kaga.*

390. Carpiniphyllum pyramidale *Gop. sp.* japonicum. *Asano, Shinano.*
391. Diatoms in Tuff. *Setanai, Shiribeshi.*

Besides, there are 26 specimens of minerals and fossils, which are not arranged in proper order on account of their larger size. The list and localities of such specimens are as follows :—

MINERALS.

392. Native Copper. *Ozaruzawa, Rikuchiu.*
393. Marcasite. *Ōdate (Aikawa), Sado.*
394. Chalcopyrite. *Ani, Ugo.*
395. Stibnite. *Ōshoin, Iyo.*
396. „ „ „
397. „ „ „
398. Rock Crystal. *Kimpōzan, Kai.*
399. „ „ „
400. „ „ „
401. Chalcedony. *Near Kitagata, Hitachi.*
402. Agate. *Nishihara, Yetchiū.*
403. Topaz. *Ōtaniyama, Ōmi.*
404. Garnet. *Arimine, Yetchiū.*
405. Rhodonite. *Ōno, Yamato.*
406. Beryl. *Sekinotsu, Omi.*
407. Orthoclase. *Kimpōzan, Kai.*

FOSSILS.

408. Subcarboniferous Fossils in Limestone. *Akasaka, Mino.*
409. Pentacrinus Stems in Schalstein. *Aobama, Buzen.*
410. Podozamites Reinii *Geyl.* *Okamigō, Hida.*
411. *a.* Onychiopsis elongata *Geyl.*

	b. Podozamites lanceolatus *Lind.*	*Shima, Kaga.*
	c. Podozamites Reinii *Geyl.*	
412.	Ginkgodium Nathorsti *Yok.*	,, ,,
413.	Pachydiscus Naumanni *Yok.*	*Urakawa, Hidaka.*
414.	Leuciscus n. sp.	*Yawataura, Iki.*
415.	Conchocele disjunctus *Gabb.*	*Iruma, Iwashiro.*
416.	Cyprina sp.?	*Saji, Ōmi,*
417.	Elephas primigenius.	*Hishi-ike, Mikawa.*

(6). SOILS.

The specimens of soils, here exhibited, were collected from those provinces where the agronomical survey has already been finished and maps published. For collecting the above specimens, special attention was given to those localities where some particular agricultural products are raised, and also to those uncultivated lands (Hara), which are in some respects capable of cultivation. The agronomical characters of the different types of soils exhibited have already been described in the explanatory texts and also in special reports;[1] accordingly the agronomical definition for each specimen is here omitted. The mechanical analysis of each specimen is, however, made to show the *products of the analysis* and its result is given with short remarks in the following tables :—

[1] Prof. Dr. M. Fesca's 'Beiträge zur Kenntniss der japanischen Landwirtschaft,' etc.

No.	1	2	3
Kind of Soil.	Clay (Mesozoic, Cretaceous Shale).	Clay (Old Quaternary).	Clay (Old Quaternary).
PROFILE.*	VII	II	I
Locality.	Arakihama, Higo.	Shimozato, Musashi (Northern part).	Jinnai, Higo.
Over 10 mm.	0.05	—	0.31
10 — 8 ,, ...	0.06	—	0.26
8 — 6 ,, ...	0.13	—	3.27
6 — 4 ,, ...	0.13	—	0.44
Sum of Gravels ...	0.27	—	1.18
Fine Soil %	99.73	100	98.12
FINE SOIL CONSISTS OF :—			
4—3 mm.	—	0.48	0.52
3—2 ,, ...	—	0.36	0.64
2—1 ,, ...	0.18	0.80	1.24
1—0.5 ,, ...	0.64	0.80	2.26
0.5—0.25 ,, ...	3.42	3.68	7.88
0.25—0.1 ,, ...	1.46	2.52	3.58
0.1—0.05 ,, ...	5.57	4.56	4.34
0.05—0.01 ,, ...	23.22	12.16	21.76
Under 0.01 ,, ...	65.50	74.64	57.62
Fine-earthy part % of Total Soil	98.87	97.59	93.59
Fine-earthy part % of Fine Soil	99.14	97.56	95.08
PERCENTAGE COMPOSIITON OF FINE-EARTHY PARTS.			
0.5—0.25 mm. ...	3.42	3.77	8.26
0.25—0.1 ,, ...	1.46	2.58	3.75
0.1—0.05 ,, ...	5.54	4.67	4.55
0.05—0.01 ,, ...	23.22	12.46	22.79
Under 0.01 ,, ...	65.50	76.51	60.62
Remark.	In the islands of Amakusa, where sugar cane is cultivated.	Surface soil of the plateau-land; chief crop is sweet potatoe (*Ipomœa Batatas*, LAM.)	Soil of the productive paddy field.

* The number of *profile* corresponds to that written on the agronomical maps already published.

No.	4	5	6
Kind of Soil.	Clay (Young Quaternary).	Clay (Young Quaternary).	Clay (Young Quaternary).
PROFILE.*	V	IV	
Locality.	Nita, Rikuzen.	Jiyoshikimen, Musashi (Northern part).	Tajima, Iwaki (Southern part).
Over 10 mm.	—	—	—
10 — 8 ,, ...	—	—	—
8 — 6 ,, ...	—	—	—
6 — 4 ,, ...	—	—	—
Sum of Gravels ...	—	—	—
Fine Soil %.....	100	100	100
FINE SOIL CONSISTS OF :—			
4—3 mm.....	—	0.06	0.32
3—2 ,, ...	—	0.06	0.44
2—1 ,, ...	0.08	0.74	1.46
1—0.5 ,, ...	0.14	6.28	2.34
0.5—0.25 ,, ...	0.24	13.42	7.08
0.25—0.1 ,, ...	0.20	2.66	4.00
0.1—0.05 ,, ...	0.98	3.30	7.92
0.05—0.31 ,, ...	4.62	12.02	23.36
Under 0.01 ,, ...	93.92	60.44	53.08
Fine-earthy part % of Total Soil	99.96	92 84	95.44
Fine-earthy port % of Fine Soil	99.96	92.84	95.44
PERCENTAGE COMPOSITION OF FINE-EARTHY PARTS.			
0.5—0.25 mm. ...	0.24	14.45	7.41
0.25—0.1 ,, ...	0.20	2.86	4.19
0.1—0.05 ,, ...	0.98	3.55	8.30
0.05—0.01 ,, ...	4.62	14.02	24.48
Under 0.01 ,, ...	93.92	65.09	55.62
Remark.	Surface soil of the hemp district (*Cannabis sativa*, L.)	Cultivates a kind of dye stuff called "Ai" (*Polygonum tinctorium*, Lour) as a chief crop.	One of the productive paddy fields in the province.

* The number of *profile* corresponds to that written on the agronomical maps already published.

7	8	9	10
Loamy Clay (Palæozoic, Chichibu System).	Loamy Clay (Young Quaternary).	Loamy Clay (Young Quaternary).	Schottery Clay (Archæan, Crystalline Schist).
V	XIII	IX	VI
Ōme, Musashi (Northern part).	Yashiro, Shinano.	Kikuchi, Higo.	Suyeno, Musashi (Northern part).
1.50	—	1.22	18.60
0.58	—	0.31	2.94
1.57	—	0.28	3.00
3.91	—	0.92	4.98
7.56	—	2.73	30.52
92.44	100	97.27	69.48
FINE SOIL CONSISTS OF :—			
2.62	0.14	0.56	4.18
2.30	0.04	1.68	2.92
6.06	0.18	5.90	4.42
5.36	0.50	6.22	3.74
8.92	6.64	12.78	10.02
4.18	14.26	7.54	6.08
5.28	22.66	6.90	8.30
9.96	24.02	18.90	16.90
54.32	31.55	39.52	43.42
77.34	99.14	83.30	58.86
83.66	99.14	85.64	84.72
PERCENTAGE COMPOSITION OF FINE-EARTHY PARTS.			
10.66	6.70	14.92	11.83
5.00	14.38	8.80	7.08
6.31	22.86	8.06	9.79
11.91	24.23	22.07	19.93
66.12	21.83	46.15	51.25
Soil of the mulberry ground on mountain slope.	Soil of the most esteemed mulberry ground.	Surface soil of the fertile paddy field, producing fine quality of rice.	Surface soil of the fertile mulberry ground on mountain slope.

No.	11	12	13
Kind of Soil.	Schottery Clay (Old Quaternary).	Schottery Clay (Young Quaternary).	Clayey Loam (Liparite).
PROFILE.*	XII		XV
Locality.	Nasuhara, Shimotsuke (Eastern part).	Wada, Hitachi.	Okada, Shinano.
Over 10 mm.	4.54	4.43	2.01
10 — 8 ,, ...	0.55	0.21	0.29
8 — 6 ,, ...	8.14	0.36	0.26
6 — 4 ,, ...	0.52	0.69	0.53
Sum of Gravels ...	5.75	5.69	3.09
Fine Soil %.....	94.25	94.31	96.91
FINE SOIL CONSISTS OF:—			
4—3 mm.....	0.66	0.82	0.08
3—2 ,, ...	0.84	0.36	0.74
2—1 ,, ...	1.06	1.12	0.52
1—0.5 ,, ...	1.90	2.46	1.38
0.5—0.25 ,, ...	13.38	8.26	15.70
0.21—0.1 ,, ...	11.02	2.68	25.62
0.1—0.05 ,, ...	11.54	7.36	14.20
0.05—0.01 ,, ...	15.26	8.18	13.30
Under 0.01 ,, ...	44.34	58.40	29.60
Fine-earthy part % of Total Soil	90.50	89.48	95.38
Fine-earthy part % of Fine Soil	95.54	94.88	98.42
PERCENTAGE COMPOSITION OF FINE-EARTHY PARTS.			
0.5—0.25 mm. ...	14.00	8.71	15.95
0.25—0.01 ,, ...	11.53	2.82	26.03
0.1—0.05 ,, ...	12.08	7.76	14.42
0.05—0.01 ,, ...	15.97	19.16	13.51
Under 0.01 ,, ...	46.41	61.55	30.06
Remark.	Extensive uncultivated land (Hara).	Surface soil of the cotton field (*Gossypium herbaceum*, L.).	Mulberry ground on mountain slope.

* The number of *profile* corresponds to that written on the agronomical maps already published.

14	15	16	17
Clayey Loam (Old Quaternary).	Clayey Loam (Young Quaternary).	Loam (Granite)	Loam (Aso Ash).
VII	II	XIII	XVI
Sayama, Musashi (Northern part).	Kawashiri, Shimōsa (Southern part).	Nakagoshizaka, Higo.	Miyagi, Higo.
—	—	1.18	—
—	—	0.19	—
—	—	0.24	—
—	—	1.05	—
—	—	2.65	—
100	100	97.35	—
FINE SOIL CONSISTS OF :—			
—	0.08	0.58	0.10
0.06	—	1.74	0.30
0.22	0.48	7.00	2.16
0 74	3.00	7.60	4.40
4.88	20.18	11.86	20.32
7.52	20.20	7.10	22.68
3.52	5.28	10.70	15.82
13 28	8.30	16.28	11.46
69.78	42.48	39.34	22.76
98.98	96.44	83.08	93.04
98.98	99.44	84.28	93.04
PERCENTAGE COMPOSITION OF FINE-EARTHY PARTS.			
4.93	20.92	13.91	21.84
7.60	20.94	8.32	24.38
3.55	5.47	12.55	17.00
13.42	8 61	19.09	12.32
70.50	44 05	46.13	24.46
A well known tea district of Japan.	Surface soil of the paddy field.	Fertile paddy field, producing fine quality of rice.	The northern slope of Aso mountain, where maize is chiefly cultivated.

No.	18	19	20
Kind of Soil.	Loam (Tertiary Tuff Shale).	Loam (Old Quaternary).	Loam (Young Quaternary).
PROFILE.*	V	XII	XIII.
Locality.	Ishiki, Sagami.	Hatano, Sagami.	Fuseguro, Iwashiro.
Over 10 mm.	3.21	0.45	—
10 — 8 ,, ...	1.72	0.76	—
8 — 6 ,, ...	0.51	2.23	—
6 — 4 ,, ...	2.26	4.30	—
Sum of Gravels ...	7.60	6.74	—
Fine Soil %.....	92.40	93.20	100
FINE SOIL CONSISTS OF:—			
4—3 mm.....	0.26	4.86	—
3—2 ,, ...	0.22	7.40	—
2—1 ,, ...	0.74	19 60	0.20
1—0.5 ,, ...	0.50	19.42	0.92
0.5—0.25 ,, ...	13.46	13.44	14.48
0.21—0.1 ,, ...	28.76	3.42	16.80
0.1—0.05 ,, ...	21.80	3.34	18.96
0.05—0.01 ,, ...	14.38	9 92	18.24
Under 0.01 ,, ...	20.26	20.18	30.30
Fine-earthy part % of Total Soil	91.17	46.91	98.77
Fine-earthy part % of Fine Soil	98.66	53.30	98.77
PERCENTAGE COMPOSITION OF FINE-EARTHY PARTS.			
0.5—0.25 mm. ...	13.65	26.71	14.57
0.25—0.10 ,, ...	29.15	6.79	17.00
0.1—0.05 ,, ...	22.09	6.64	19.19
0.05—0.01 ,, ...	14 58	19.72	18.46
Under 0.01 ,, ...	20.54	40.12	30.67
Remark.	Subsoil of the cultivated land; it has generally low fertility.	A well known tobacco district under the name of Hatano.	Surface soil of the most esteemed mulberry ground.

* The number of *profile* corresponds to that written on the agronomical maps already published.

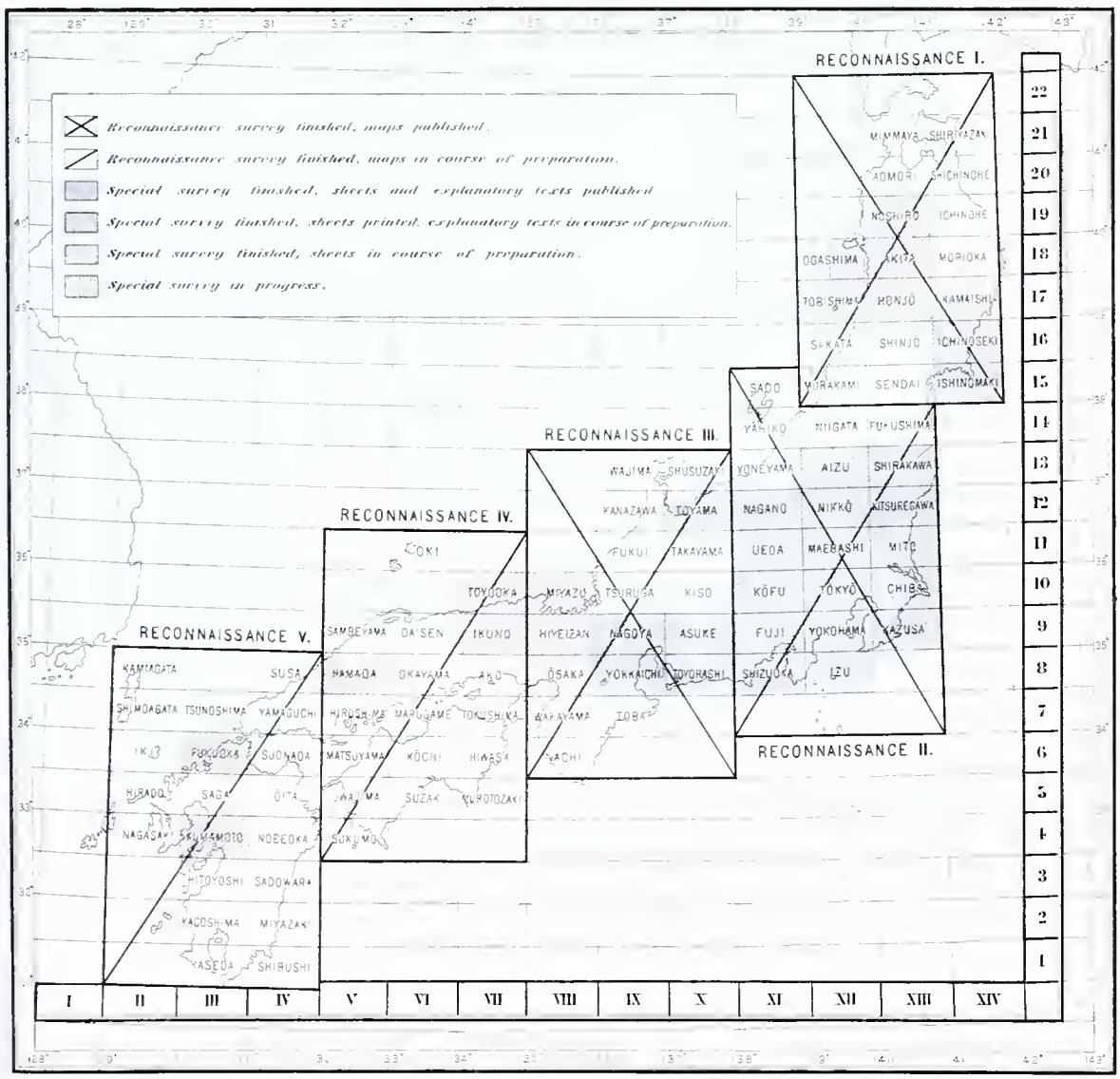
21	22	23	24
Loam (Young Quaternary).	Loam (Young Quaternary).	Loam (Young Quaternary).	Sandy Loam (Fuji Lava).
XIII	VII	XIX	
Nonoichi, Kaga.	Kanuma, Shimotsuke (Western part).	Daimon, Hitachi.	Yamura, Kai.
0.64	2.58	1.19	2.49
0.11	0.45	0.33	0.62
6.03	0.38	0.32	1.21
0.31	0.32	1.06	2.91
1.09	3.73	2.90	7.22
98.91	96.27	97.10	92.77
FINE SOIL CONSISTS OF:—			
0.10	0.72	0.84	1.76
0.30	0.50	1.82	2.58
1.28	1.40	6.32	5.12
1.88	4.42	9.42	5.46
12.92	26.76	25.82	13.36
15.84	14.84	14.62	9.96
15.24	14.20	8.18	7.88
18.62	15.00	9.78	24.56
34.28	23.02	23.26	29.44
95.84	90.32	79.29	79.04
96.90	93.82	81.66	85.20
PERCENTAGE COMPOSITION OF FINE-EARTHY PARTS.			
13.33	28.52	31.62	15.68
16.34	16.59	17.90	11.69
15.72	15.13	10.02	9.24
19.21	15.14	11.98	28.82
35.38	24.54	28.48	34.55
Surface soil of the paddy field.	A well known hemp district of Japan.	Cultivates tobacco known under the name of Kumoi.	At the north side of Fuji, where mulberry is extensively planted.

No.	25	26	27
Kind of Soil.	Sandy Loam (Young Quaternary).	Schottery Loam (Andesite).	Schottery Loam (Asama Lava).
PROFILE.*	XXIII		XL
Locality.	Hiroshima, Aki.	Asahiyama, Iwaki (Southern part).	Kutsukake, Shinano.
Over 10 mm.	0.27	16.52	2.78
10 — 8 ,, ...	0.05	1.31	1.28
8 — 6 ,, ...	0.04	1.77	1.47
6 — 4 ,, ...	1.88	2.93	2.64
Sum of Gravels ...	2.04	22.53	8.17
Fine Soil %	97.96	77.47	91.83
FINE SOIL CONSISTS OF :—			
4—3 mm.....	0.10	1.72	0.90
3—2 ,, ...	9.94	1.92	1.12
2—1 ,, ...	9.24	5.58	4.34
1—0.5 ,, ...	21.46	9.54	7.72
0.0--0.25 ,, ...	34.32	21.94	22.68
0.25—0.1 ,, ...	6.74	6.64	8.00
0.1—0.05 ,, ...	3.78	5.96	4.60
0.05—0.05 ,, ...	5.04	22.38	22.62
Under 0.01 ,, ...	18.52	24.74	27.96
Fine-earthy part % of Total Soil	67.00	63.26	78.84
Fine-earthy part % of Fine Soil.	68.40	81.66	85.86
PERCENTAGE COMPOSITION OF FINE-EARTHY PARTS.			
0.5—0.25 mm. ...	50.18	26.99	26.40
0.25—0.10 ,, ...	9.85	8.13	9.31
0.1—0.05 ,, ...	5.52	7.29	5.35
0.05—0 01 ,, ...	7.37	27.41	26.33
Under 0.01 ,, ...	27.08	30.03	32.66
Remark.	Mostly cultivates Ai (*Polygonum tinctorium*, Lour) and cotton alternately.	Where rice is chiefly cultivated; one of the fertile soils among volcanic districts.	Uncultivated land (Hara) at the foot of Asama Mountain.

* The number of *profile* corresponds to that written on the agronomical maps already published.

28	29	30	31	32
Schottery Loam (Tertiary Tuff).	Loamy Sand (Granite).	Loamy Sand (Young Quaternary).	Sand (Young Quaternary).	Schottery Sand (Granite).
	XX	XXXVIII		
Hamabe, Iwashiro	Nihonmatsu, Iwashiro.	Sakaimachi, Kōtsuke.	Yonigahama, Hōki.	Tanna, Aki.
7.88	1.19	9.15	—	6.77
1.05	0.42	1.94	—	2.15
1.13	1.06	1.80	—	3.32
2.07	4 38	5.07	—	9.86
13.13	7.05	17.96	—	22 10
86.87	92.95	82.04	—	87.90
FINE SOIL CONSISTS OF :—				
2.76	4.34	3.34	0.20	7.40
2.60	8.52	2.18	0.50	10.44
5.62	19.58	7.06	0.88	22.88
7.06	23.28	16 58	1.30	14.82
26.20	25.04	35.98	70.04	17.02
10.88	7.74	6 46	11.90	5.24
7.96	4.92	3.68	2.38	8.48
8.72	2.04	4.92	3.20	5.46
28 44	4.54	20.12	9.74	2.12
71.41	41.16	58.38	97.26	39 84
82.20	44.28	71.16	97.26	45.32
PERCENTAGE COMPOSITION OF FINE-EARTHY PARTS.				
31.87	56.55	50.25	72.01	37.55
13.23	17.48	9.07	12.23	11.56
9.68	11.11	5.17	2.44	18.73
10.61	4.61	6.91	3.29	12.05
34.59	10.25	29.41	10.01	20.34
Surface soil of the mulberry ground.	A kind of soil most suited for mulberry plantation.	Soil of an extensive mulberry ground.	One of the famous cotton districts of Japan.	Weathered granite land most suitable for cotton plantation in this locality.

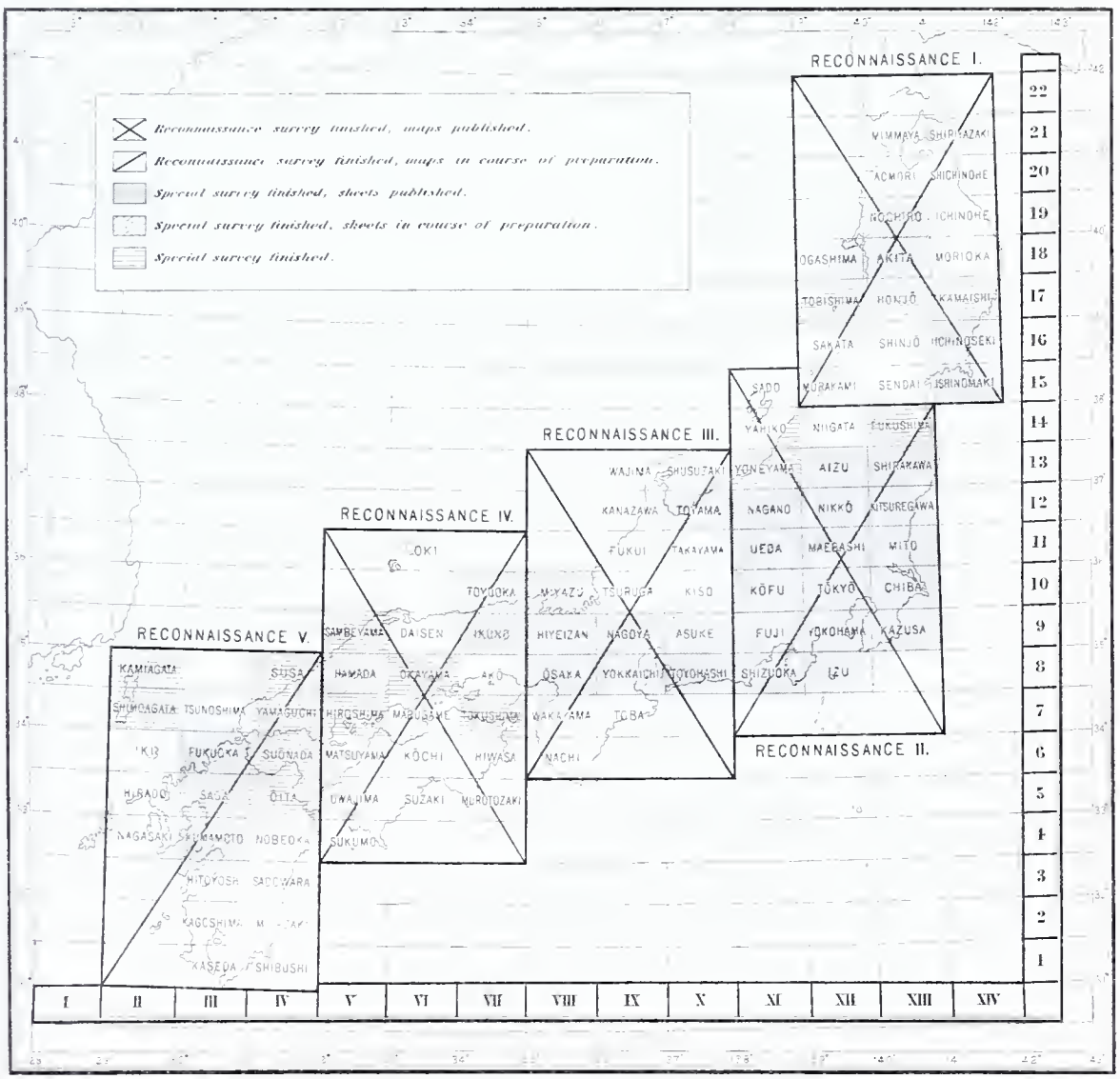
MAP
SHOWING THE PROGRESS
OF THE
GEOLOGICAL SURVEY OF JAPAN
UP TO AND INCLUDING
1892
(HOKKAIDŌ EXCLUDED).



NB. The letters on each sheet represent its name; the Arabic figures in the vertical and Roman in the horizontal columns indicate the number of each sheet.

MAP
SHOWING THE PROGRESS
OF THE
AGRONOMIC SURVEY OF JAPAN
UP TO
1892
(HOKKAIDŌ EXCLUDED).

MAP
SHOWING THE PROGRESS
OF THE
TOPOGRAPHICAL SURVEY OF JAPAN
UP TO AND INCLUDING
1892
(HOKKAIDŌ EXCLUDED).



NB. The letters on each sheet represent its name; the Arabic figures in the vertical and Roman in the horizontal columns indicate the number of each sheet.

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